OIPE JC156
APR 23 2004
PATENT & TRADEMARK OFFICE

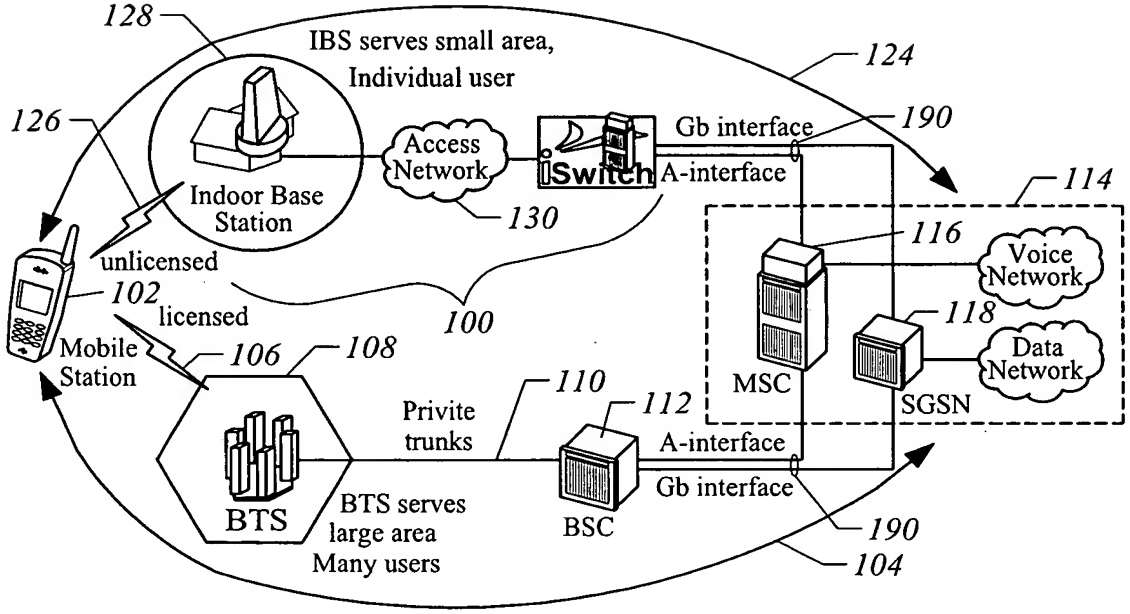

FIG. 1A

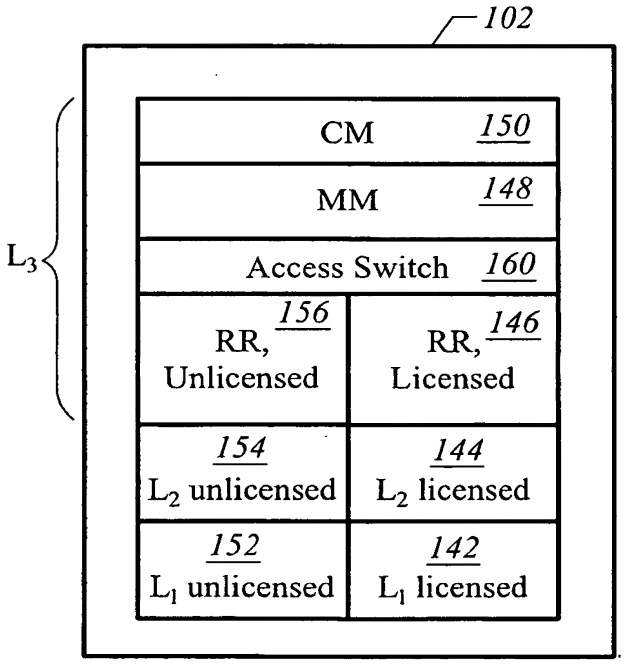

FIG. 1B

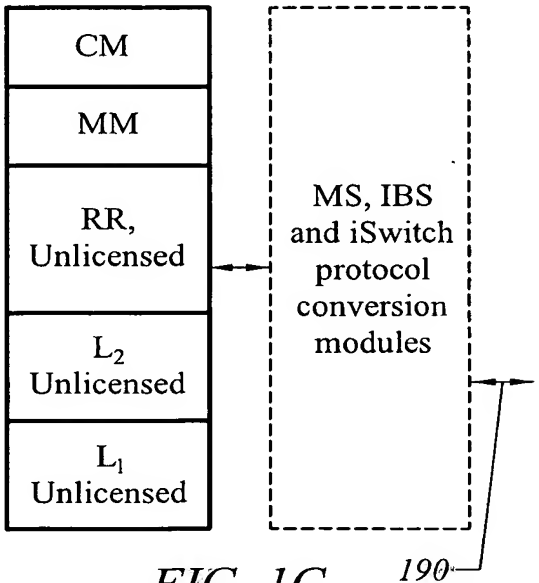

FIG. 1C

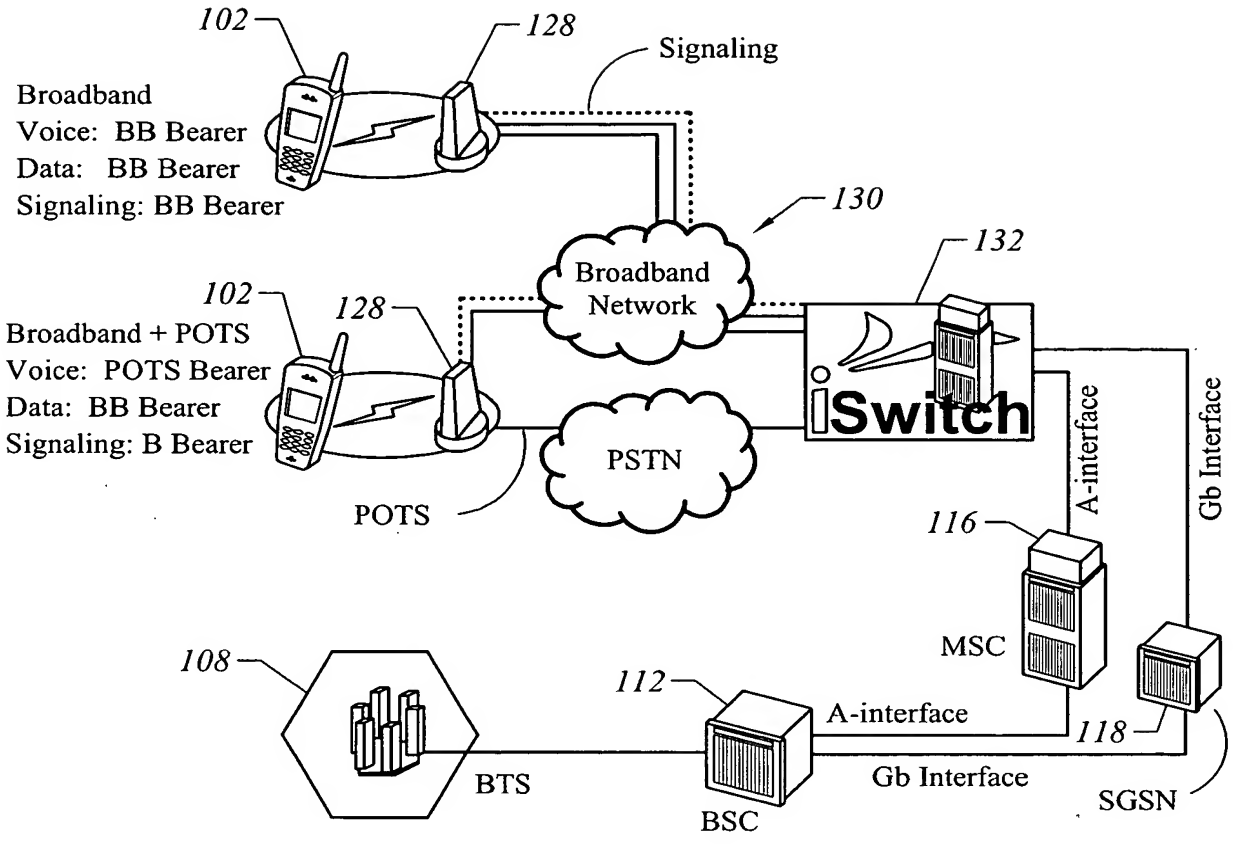
102
128
Signaling
Broadband
Voice: BB Bearer
Data: BB Bearer
Signaling: BB Bearer
130
132
Broadband
Network
102
128
Broadband + POTS
Voice: POTS Bearer
Data: BB Bearer
Signaling: B Bearer
iSwitch
PSTN
POTS
A-interface
Gb Interface
116
MSC
108
112
A-interface
118
BTS
Gb Interface
SGSN
BSC

FIG. 2

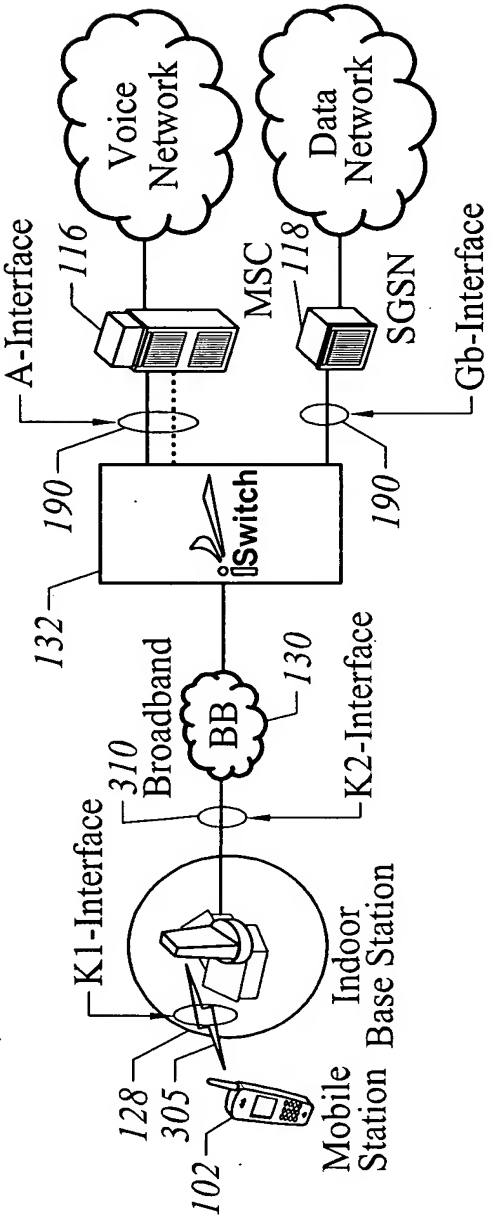
Voice Network
Data Network
A-Interface
116
MSC
118
SGSN
Gb-Interface
190
Switch
190
132
Broadband
BB
130
310
K2-Interface
K1-Interface
Indoor Base Station
128
305
102
Mobile Station

FIG. 3

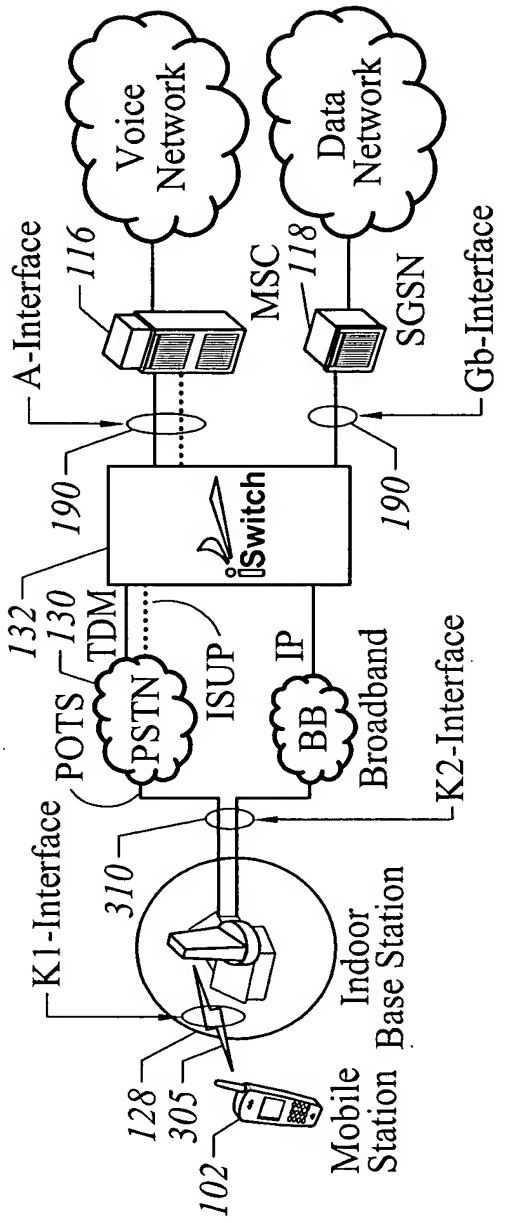
Voice Network
Data Network
A-Interface
116
MSC
118
SGSN
Gb-Interface
190
Switch
190
132
130
TDM
ISUP
IP
POTS
PSTN
BB
Broadband
K2-Interface
K1-Interface
310
Indoor Base Station
128
305
102
Mobile Station

FIG. 4

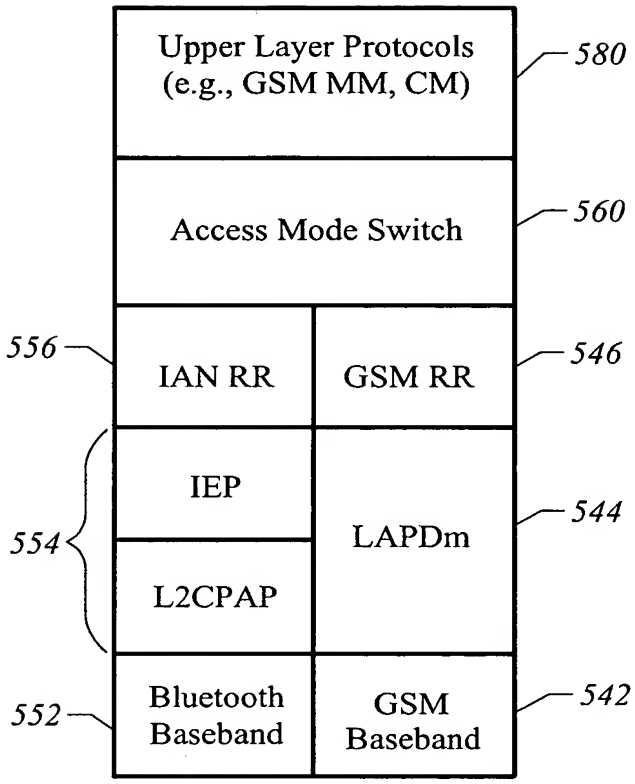
Upper Layer Protocols
(e.g., GSM MM, CM)
580
Access Mode Switch
560
556
IAN RR
GSM RR
546
IEP
554
L2CPAP
LAPDm
544
552
Bluetooth
Baseband
GSM
Baseband
542

FIG. 5

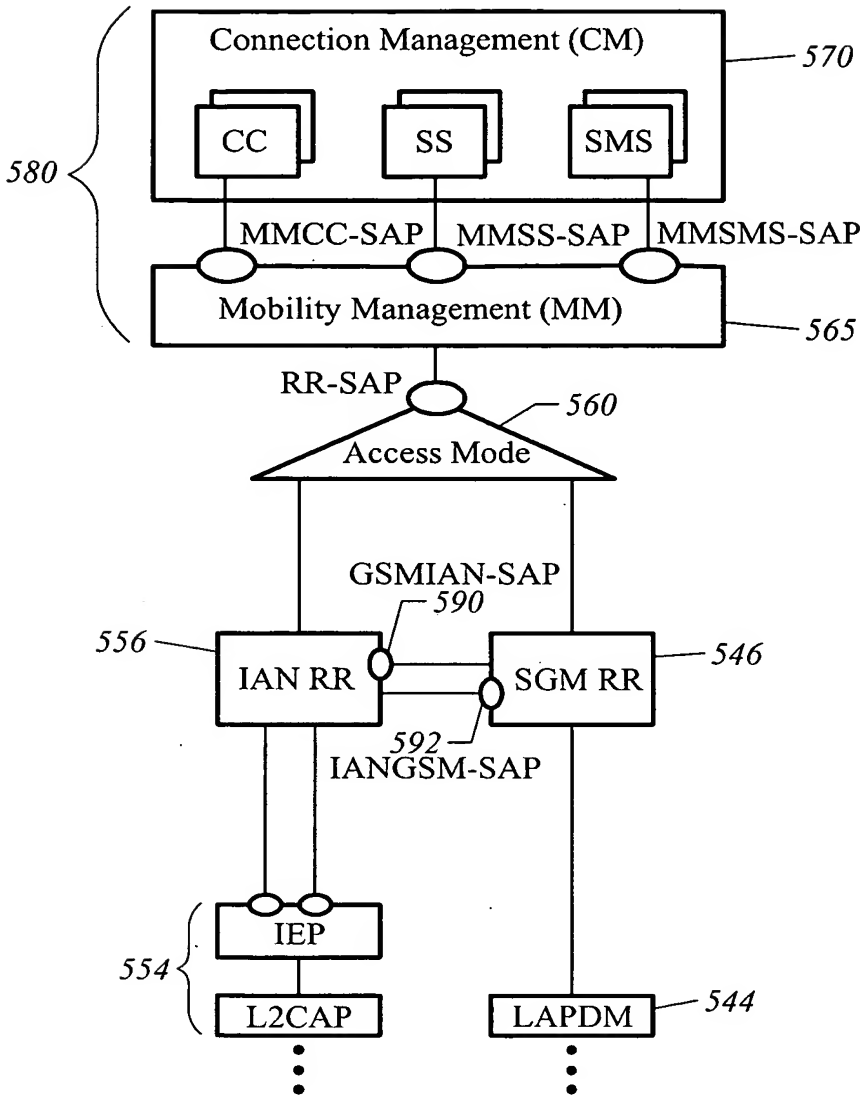
Connection Management (CM)
570
CC
SS
SMS
580
MMCC-SAP
MMSS-SAP
MMSMS-SAP
Mobility Management (MM)
565
RR-SAP
560
Access Mode
GSMIAN-SAP
590
556
IAN RR
SGM RR
546
592
IANGSM-SAP
IEP
554
L2CAP
LAPDM
544

FIG. 6

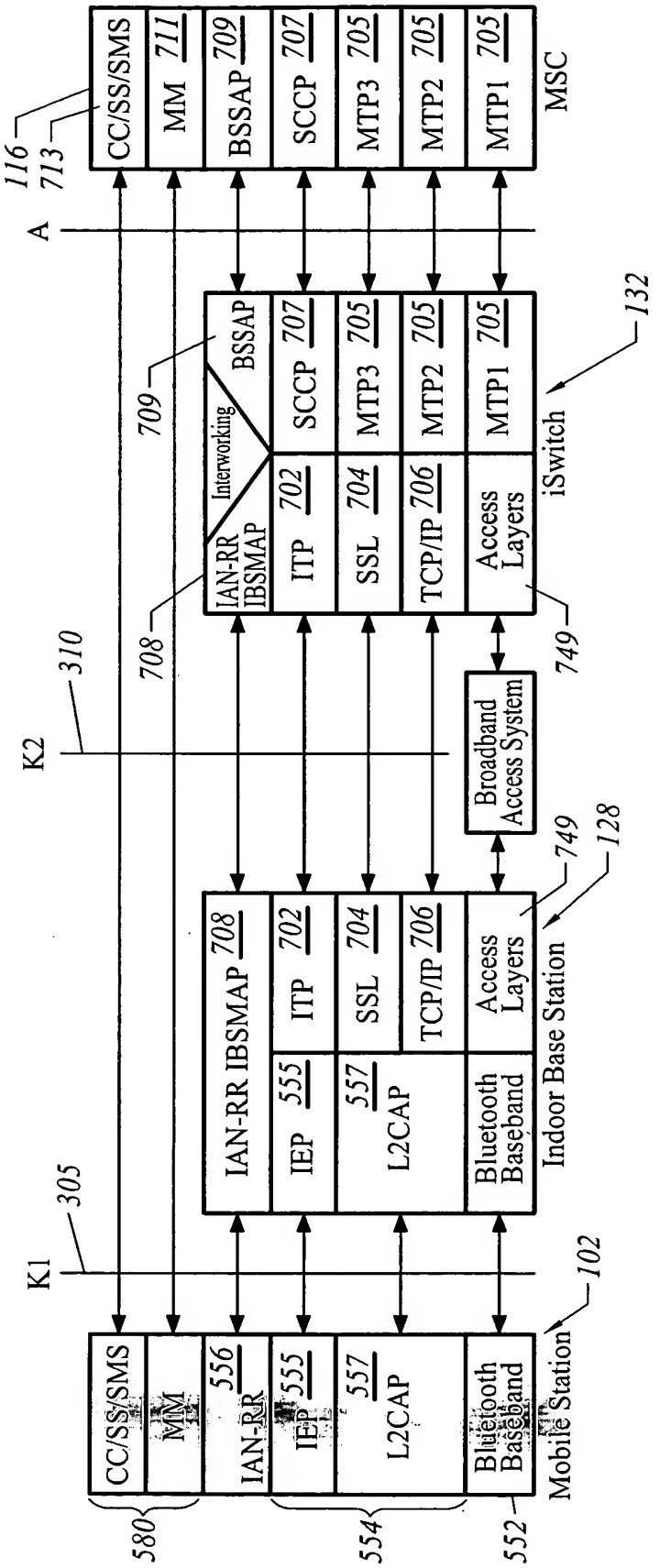
CC/SS/SMS
MM 711
BSSAP 709
SCCP 707
MTP3 705
MTP2 705
MTP1 705
MSC
116
713
A
132
iSwitch
709
BSSAP
Interworking
IAN-RR IBSMAP
ITP 702
SSL 704
TCP/IP 706
Access Layers
708
749
310
K2
Broadband Access System
128
Indoor Base Station
IAN-RR IBSMAP 708
IEP 555
L2CAP 557
Bluetooth Baseband
305
K1
102
Mobile Station
556
580
554
552

FIG. 7A

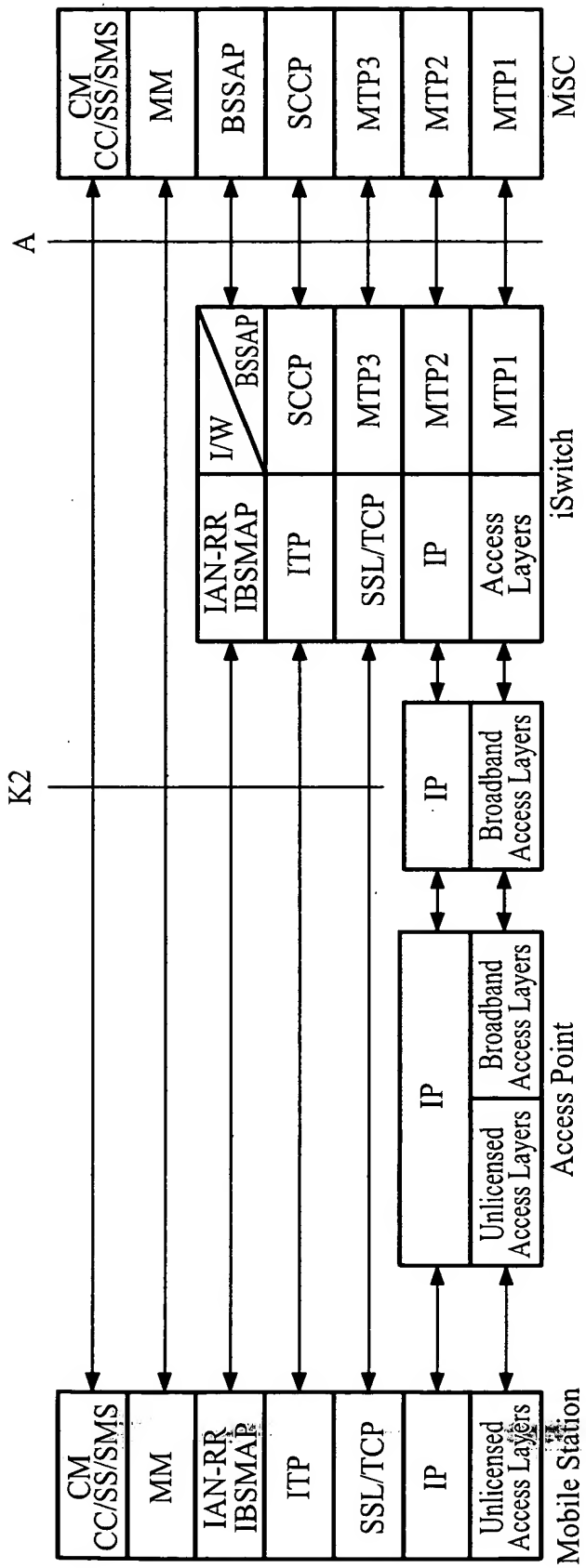
CM
CC/SS/SMS
MM
BSSAP
SCCP
MTP3
MTP2
MTP1
MSC
A
I/W
BSSAP
IAN-RR
IBSMAP
ITP
SSL/TCP
IP
Access
Layers
iSwitch
K2
IP
Broadband
Access Layers
IP
Unlicensed
Access Layers
Broadband
Access Layers
Access Point
CM
CC/SS/SMS
MM
IAN-RR
IBSMAP
ITP
SSL/TCP
IP
Unlicensed
Access Layers
Mobile Station

FIG. 7B

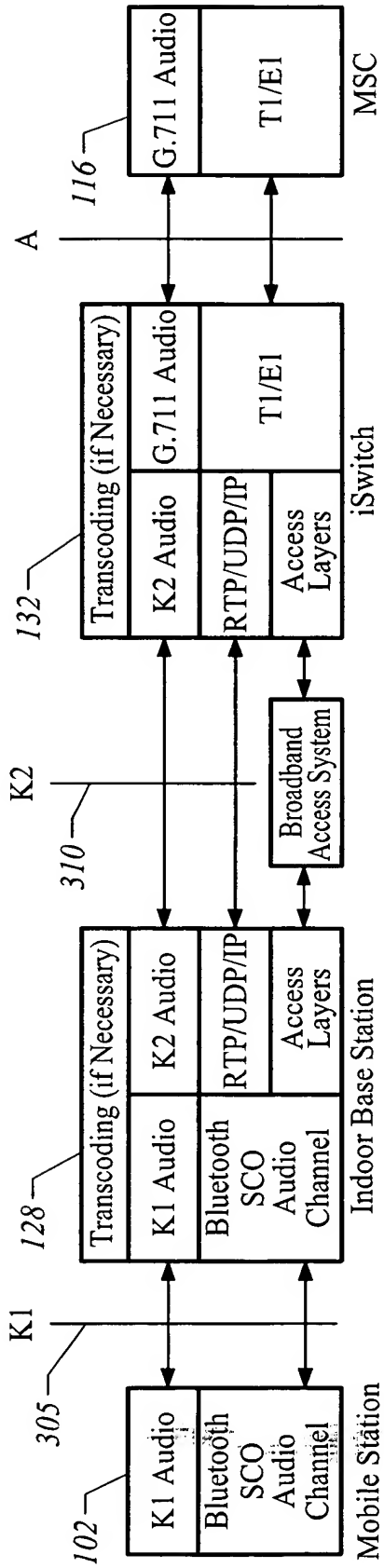
Mobile Station
Indoor Base Station
iSwitch
MSC
K1 Audio
Bluetooth SCO Audio Channel
Transcoding (if Necessary)
K1 Audio
K2 Audio
Bluetooth SCO Audio Channel
RTP/UDP/IP
Access Layers
Broadband Access System
Transcoding (if Necessary)
K2 Audio
G.711 Audio
RTP/UDP/IP
Access Layers
T1/E1
G.711 Audio
T1/E1
102
305
K1
128
310
K2
132
A
116

FIG. 8

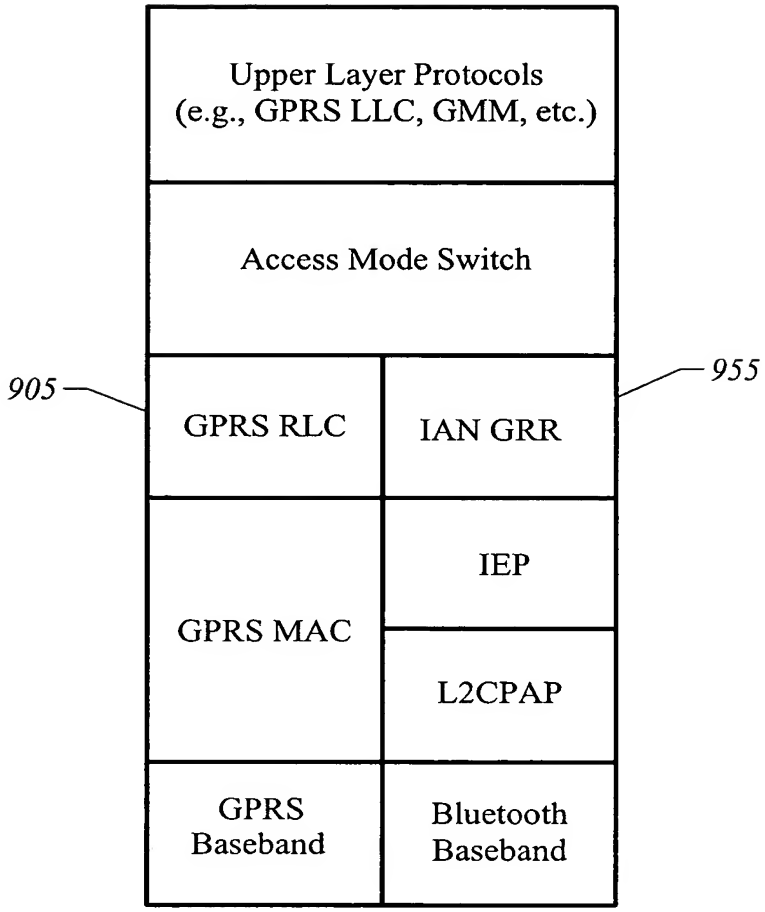
Upper Layer Protocols
(e.g., GPRS LLC, GMM, etc.)
Access Mode Switch
905
955
GPRS RLC
IAN GRR
IEP
GPRS MAC
L2CPAP
GPRS
Baseband
Bluetooth
Baseband

FIG. 9

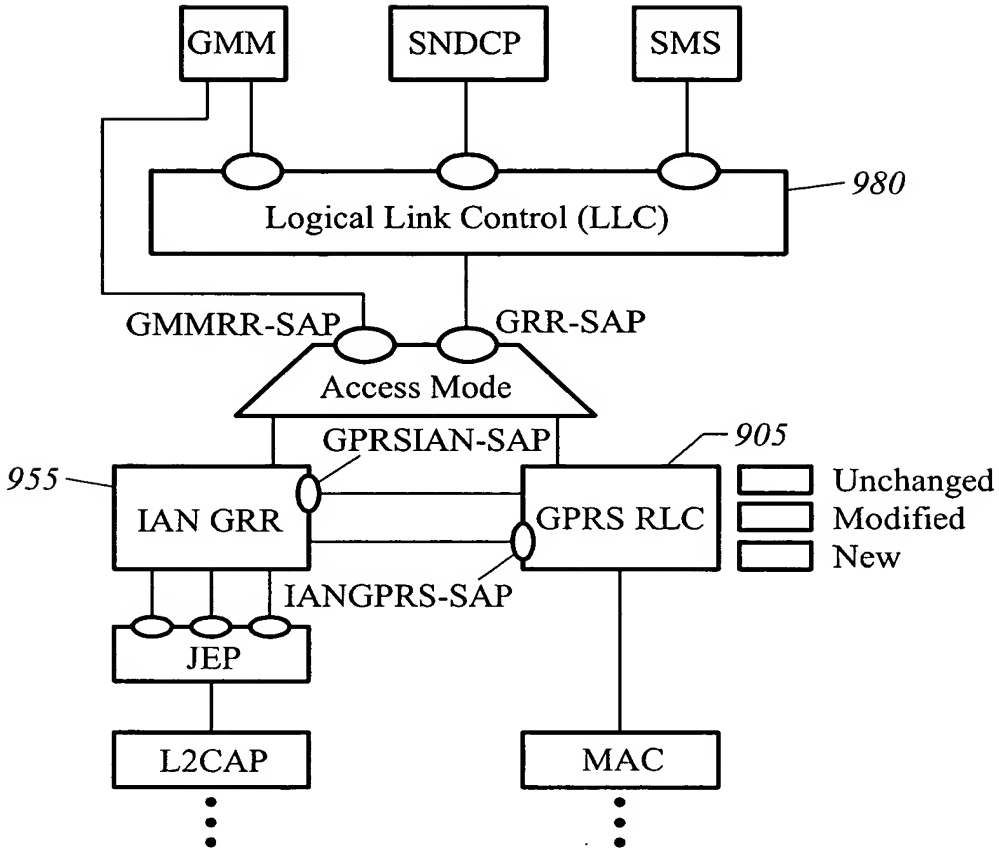
GMM
SNDCP
SMS
980
Logical Link Control (LLC)
GMMRR-SAP
GRR-SAP
Access Mode
GPRSIAN-SAP
905
955
IAN GRR
GPRS RLC
Unchanged
Modified
New
IANGPRS-SAP
JEP
L2CAP
MAC

FIG. 10

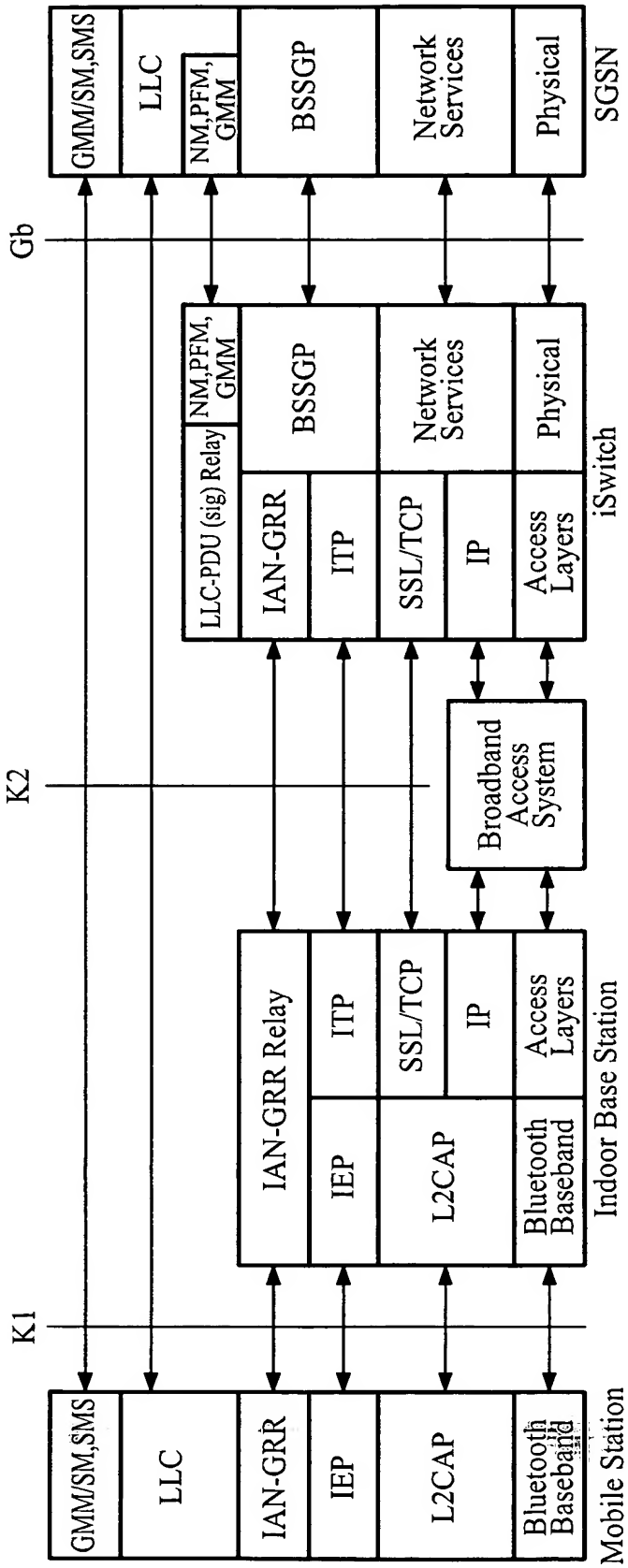
GMM/SM,SMS
LLC
NM,PFM, GMM
BSSGP
Network Services
Physical
SGSN
Gb
LLC-PDU (sig) Relay
NM,PFM, GMM
BSSGP
IAN-GRR
ITP
SSL/TCP
IP
Network Services
Physical
Access Layers
iSwitch
K2
Broadband Access System
IAN-GRR Relay
ITP
SSL/TCP
IP
Access Layers
IEP
L2CAP
Bluetooth Baseband
Indoor Base Station
K1
GMM/SM,SMS
LLC
IAN-GRR
IEP
L2CAP
Bluetooth Baseband
Mobile Station

FIG. 11A

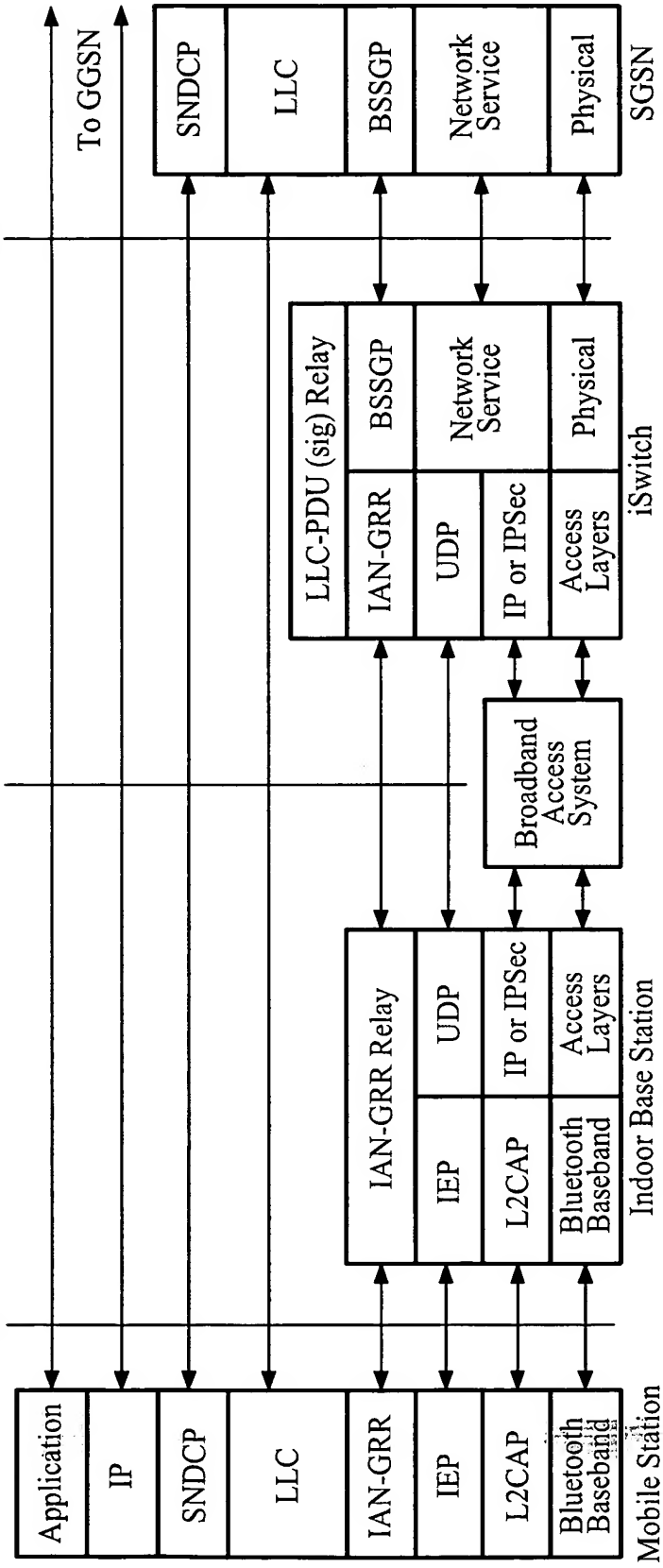
To GGSN
Gb
K2
K1
SNDCP
LLC
BSSGP
Network Service
Physical
SGSN
LLC-PDU (sig) Relay
IAN-GRR
UDP
IP or IPSec
Access Layers
iSwitch
Broadband Access System
IAN-GRR Relay
IEP
L2CAP
Bluetooth Baseband
Indoor Base Station
Application
IP
Mobile Station

FIG. 11B

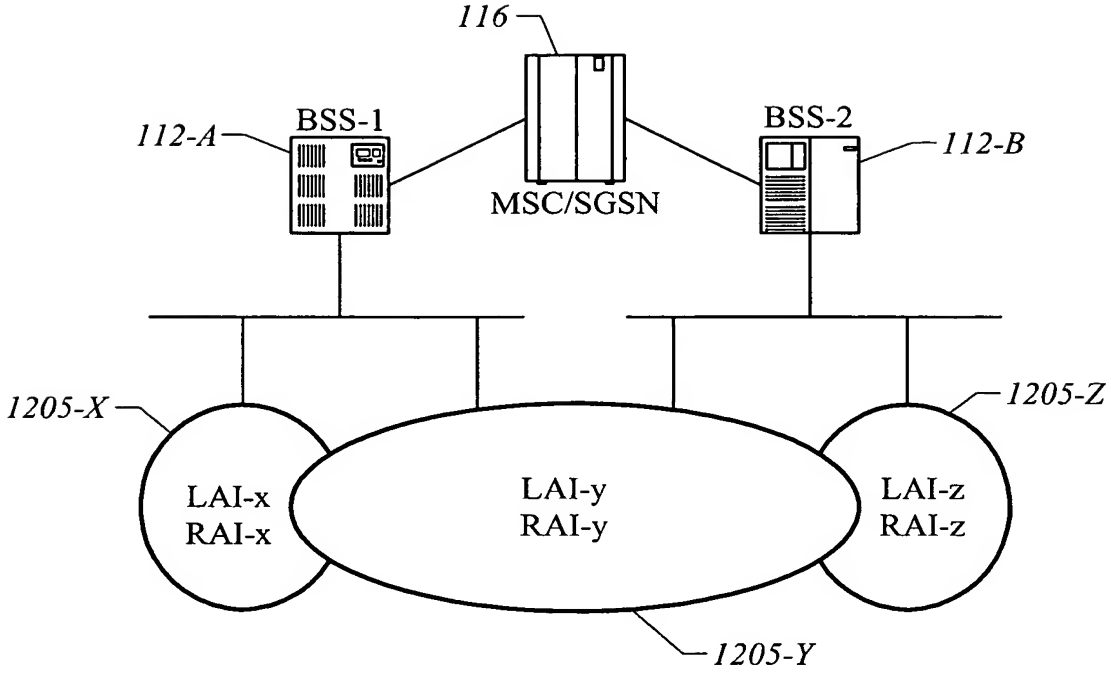
116
BSS-1
112-A
MSC/SGSN
BSS-2
112-B
1205-X
1205-Z
LAI-x
RAI-x
LAI-y
RAI-y
LAI-z
RAI-z
1205-Y

FIG. 12

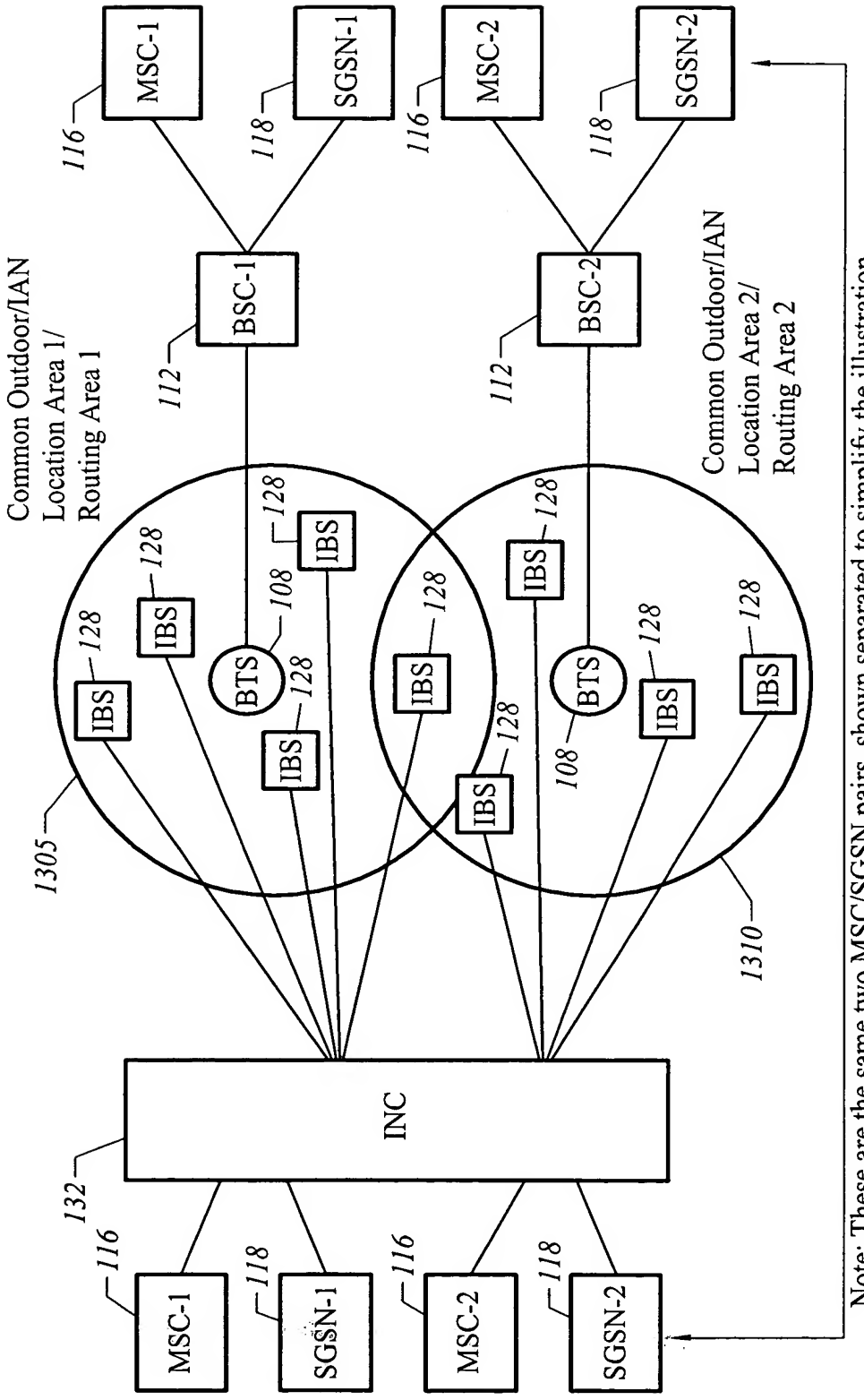
MSC-1
SGSN-1
MSC-2
SGSN-2
116
118
116
118
BSC-1
BSC-2
112
112
Common Outdoor/IAN
Location Area 1/
Routing Area 1
Common Outdoor/IAN
Location Area 2/
Routing Area 2
1305
1310
BTS
BTS
108
108
IBS
128
INC
132
Note: These are the same two MSC/SGSN pairs, shown separated to simplify the illustration

FIG. 13

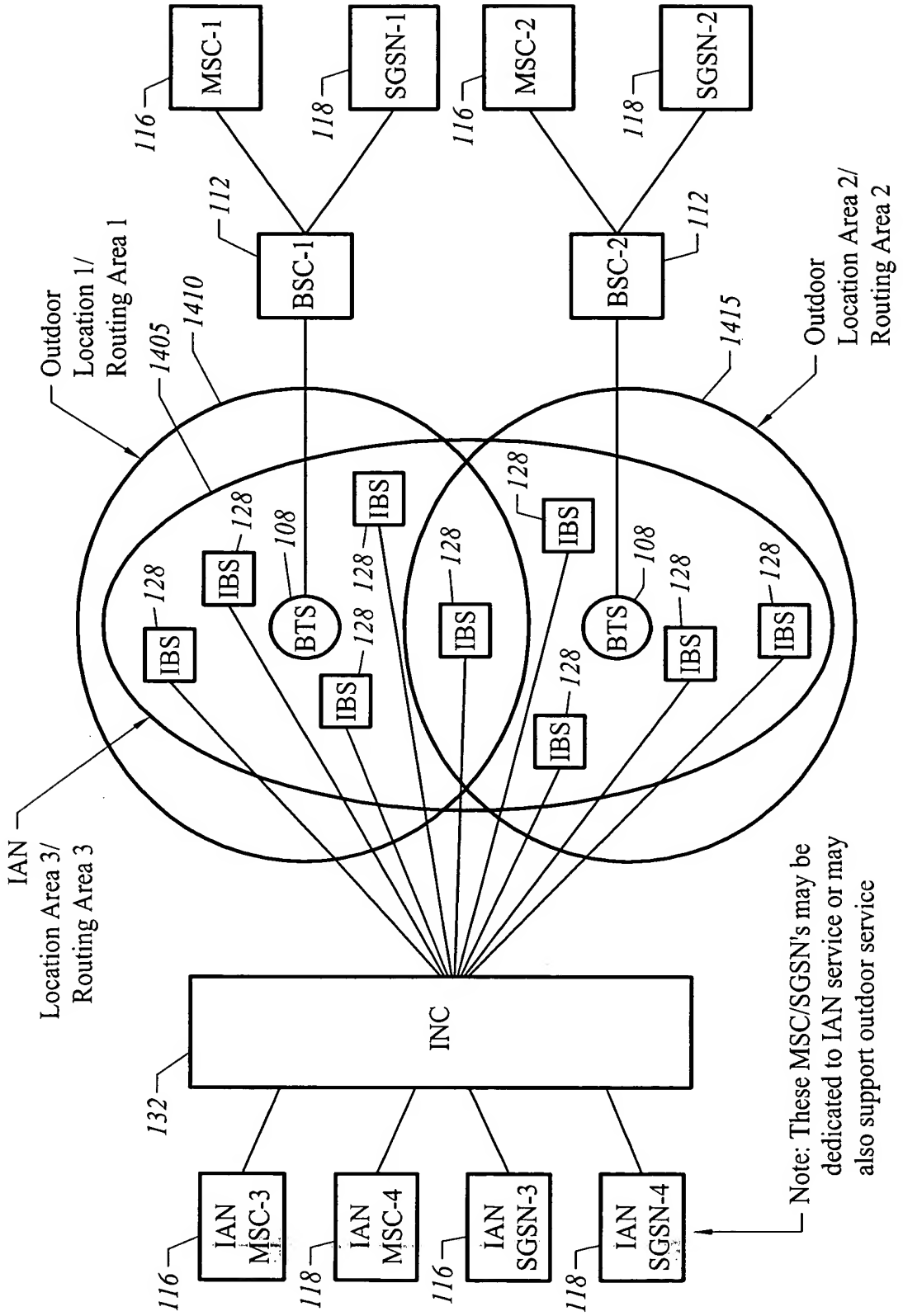
MSC-1
SGSN-1
MSC-2
SGSN-2
116
118
112
BSC-1
BSC-2
Outdoor
Location 1/
Routing Area 1
Outdoor
Location Area 2/
Routing Area 2
1405
1410
1415
IBS
BTS
128
108
IAN
Location Area 3/
Routing Area 3
INC
132
IAN
MSC-3
IAN
MSC-4
IAN
SGSN-3
IAN
SGSN-4
Note: These MSC/SGSN's may be
dedicated to IAN service or may
also support outdoor service

FIG. 14

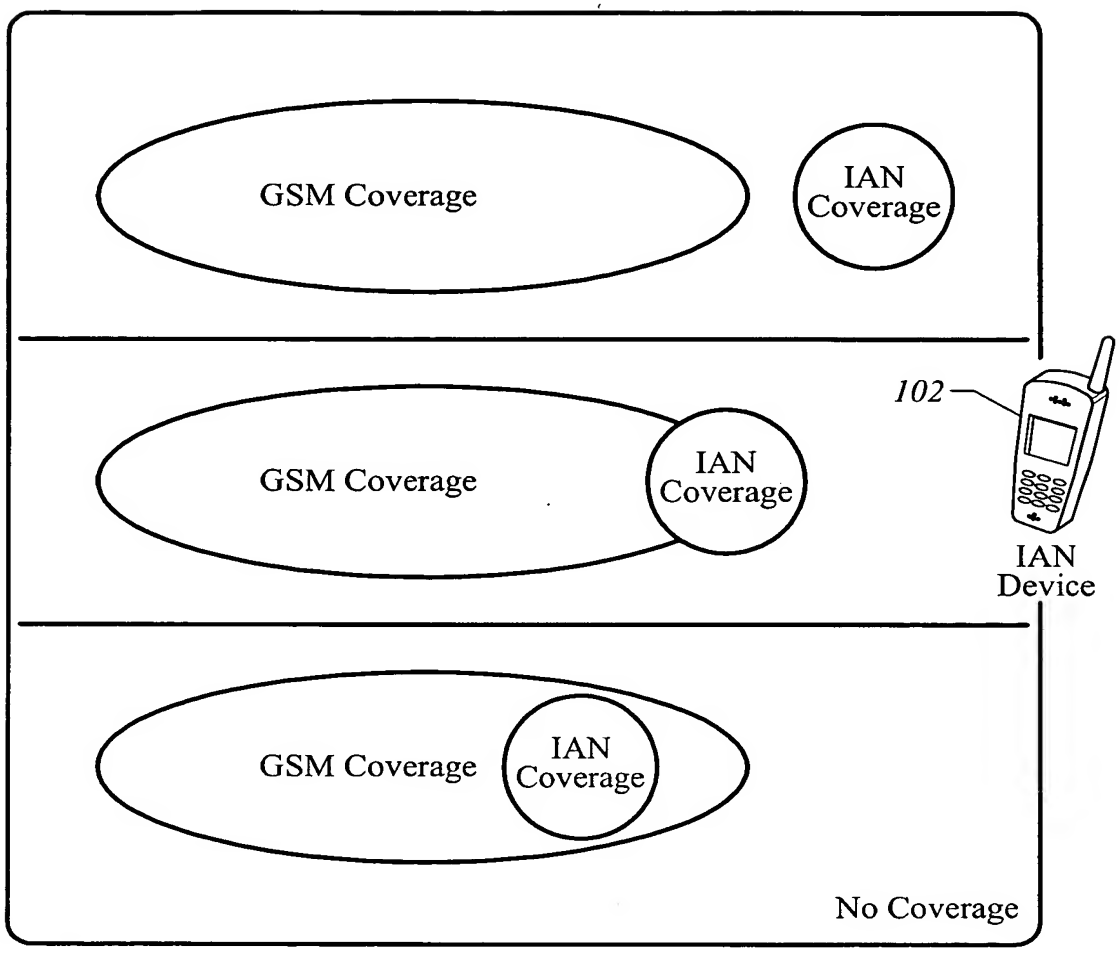
GSM Coverage
IAN Coverage
GSM Coverage
IAN Coverage
GSM Coverage
IAN Coverage
No Coverage
102
IAN Device

FIG. 15

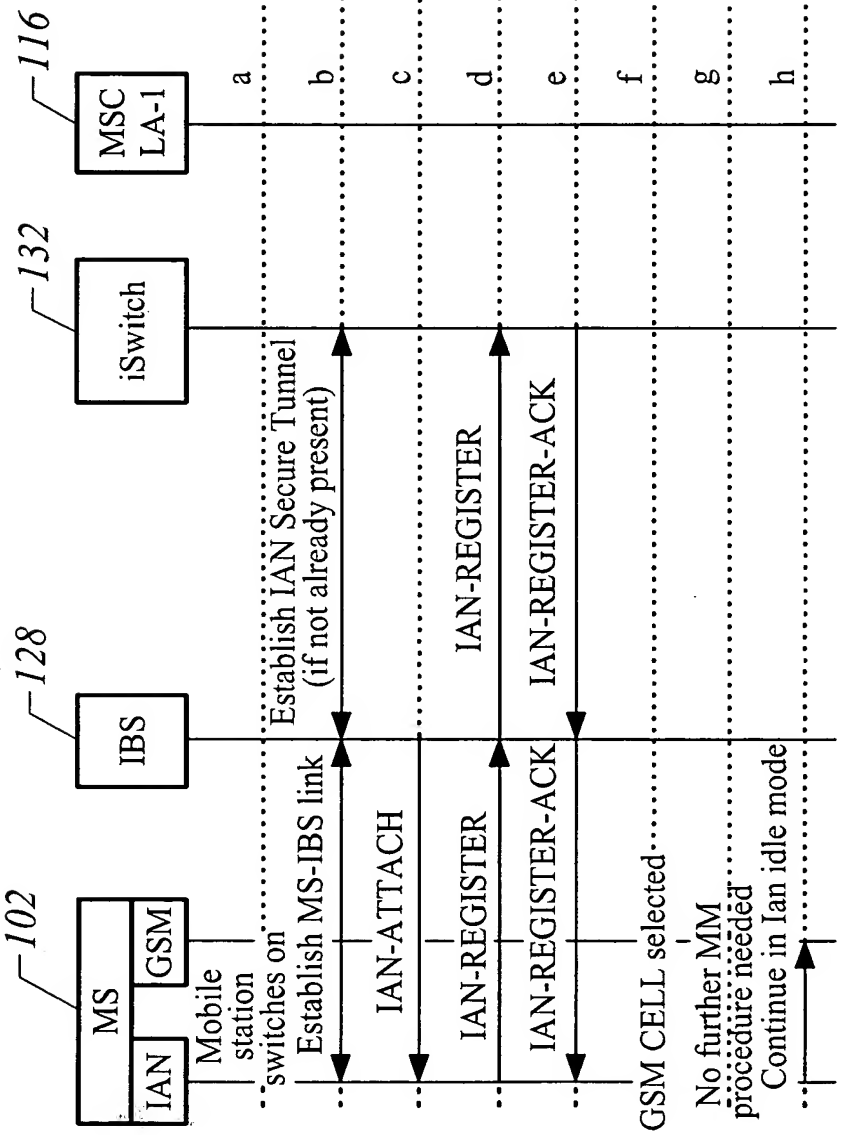
102
MS
IAN
GSM
128
IBS
132
iSwitch
116
MSC
LA-1
a
Mobile station switches on
b
Establish MS-IBS link
Establish IAN Secure Tunnel (if not already present)
c
IAN-ATTACH
d
IAN-REGISTER
IAN-REGISTER
e
IAN-REGISTER-ACK
IAN-REGISTER-ACK
f
GSM CELL selected
g
No further MM procedure needed
h
Continue in Ian idle mode

FIG. 16

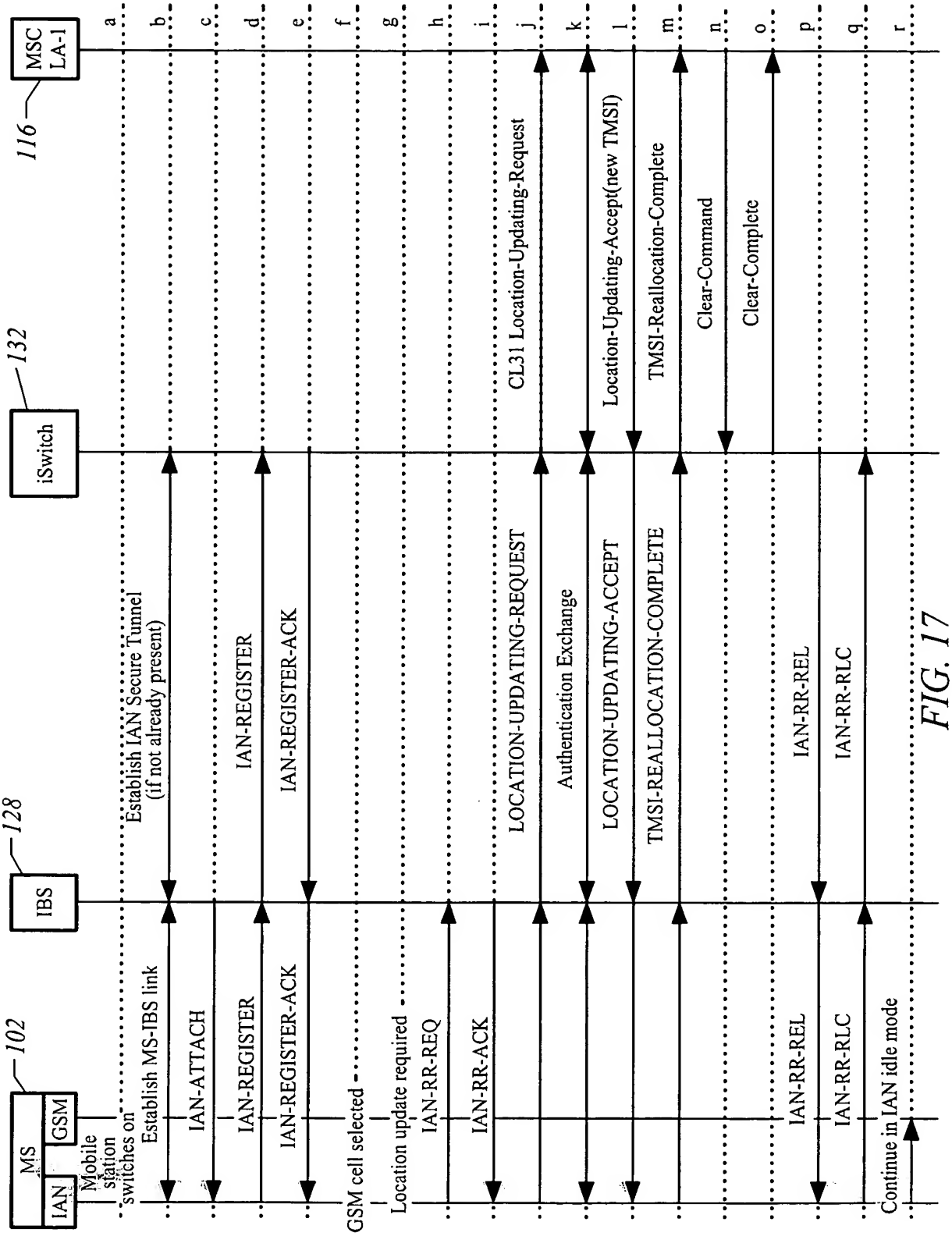
MS
IAN
GSM
102
IBS
128
iSwitch
132
MSC
LA-1
116
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
Mobile station switches on
Establish MS-IBS link
Establish IAN Secure Tunnel (if not already present)
IAN-ATTACH
IAN-REGISTER
IAN-REGISTER
IAN-REGISTER-ACK
IAN-REGISTER-ACK
GSM cell selected
Location update required
IAN-RR-REQ
IAN-RR-ACK
LOCATION-UPDATING-REQUEST
CL31 Location-Updating-Request
Authentication Exchange
LOCATION-UPDATING-ACCEPT
Location-Updating-Accept(new TMSI)
TMSI-REALLOCATION-COMPLETE
TMSI-Reallocation-Complete
Clear-Command
Clear-Complete
IAN-RR-REL
IAN-RR-REL
IAN-RR-RLC
IAN-RR-RLC
Continue in IAN idle mode

FIG. 17

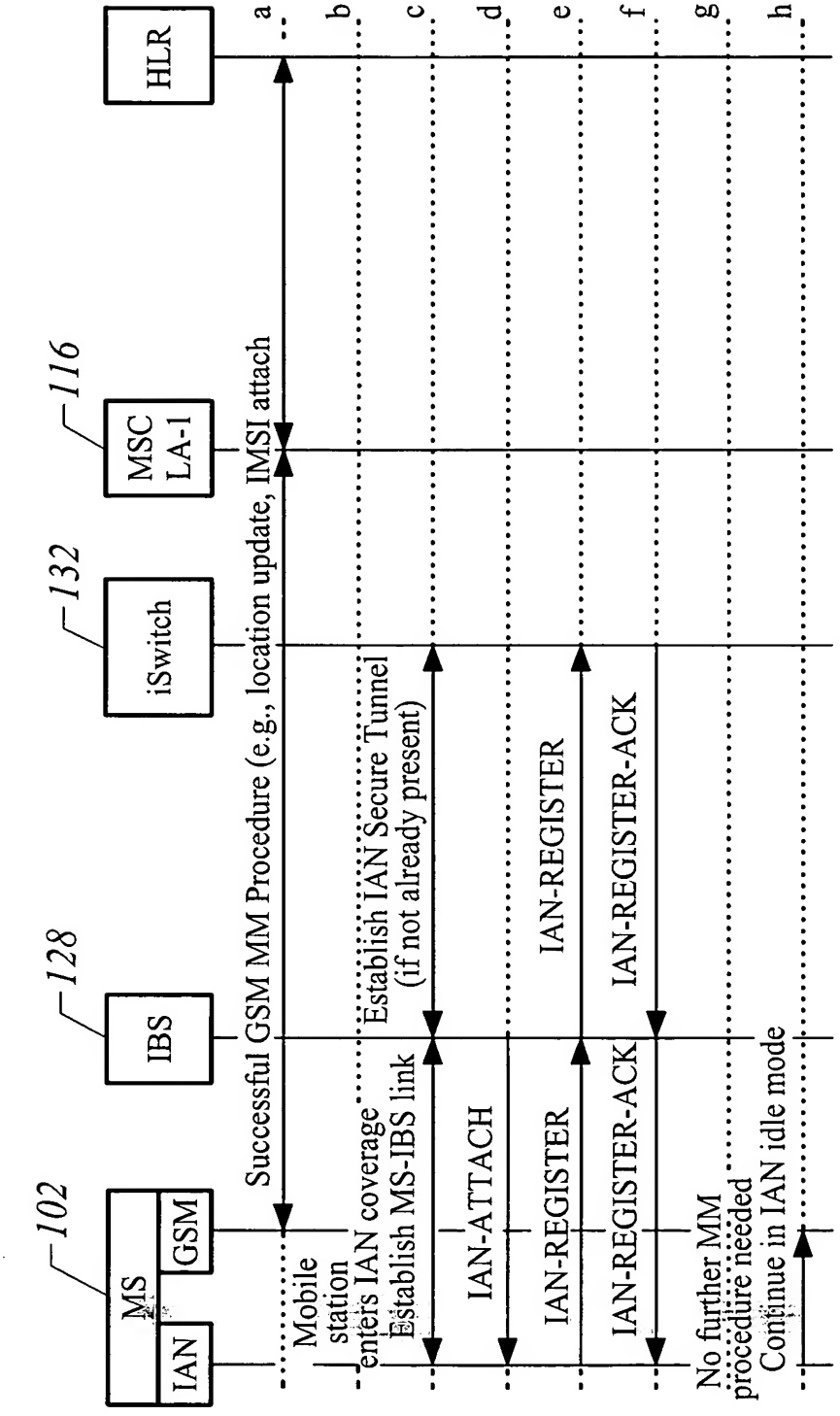
102
MS
IAN
GSM
128
IBS
132
iSwitch
116
MSC
LA-1
HLR
a
b
c
d
e
f
g
h
Successful GSM MM Procedure (e.g., location update, IMSI attach
Mobile station enters IAN coverage
Establish IAN Secure Tunnel (if not already present)
Establish MS-IBS link
IAN-ATTACH
IAN-REGISTER
IAN-REGISTER
IAN-REGISTER-ACK
IAN-REGISTER-ACK
No further MM procedure needed
Continue in IAN idle mode

FIG. 18

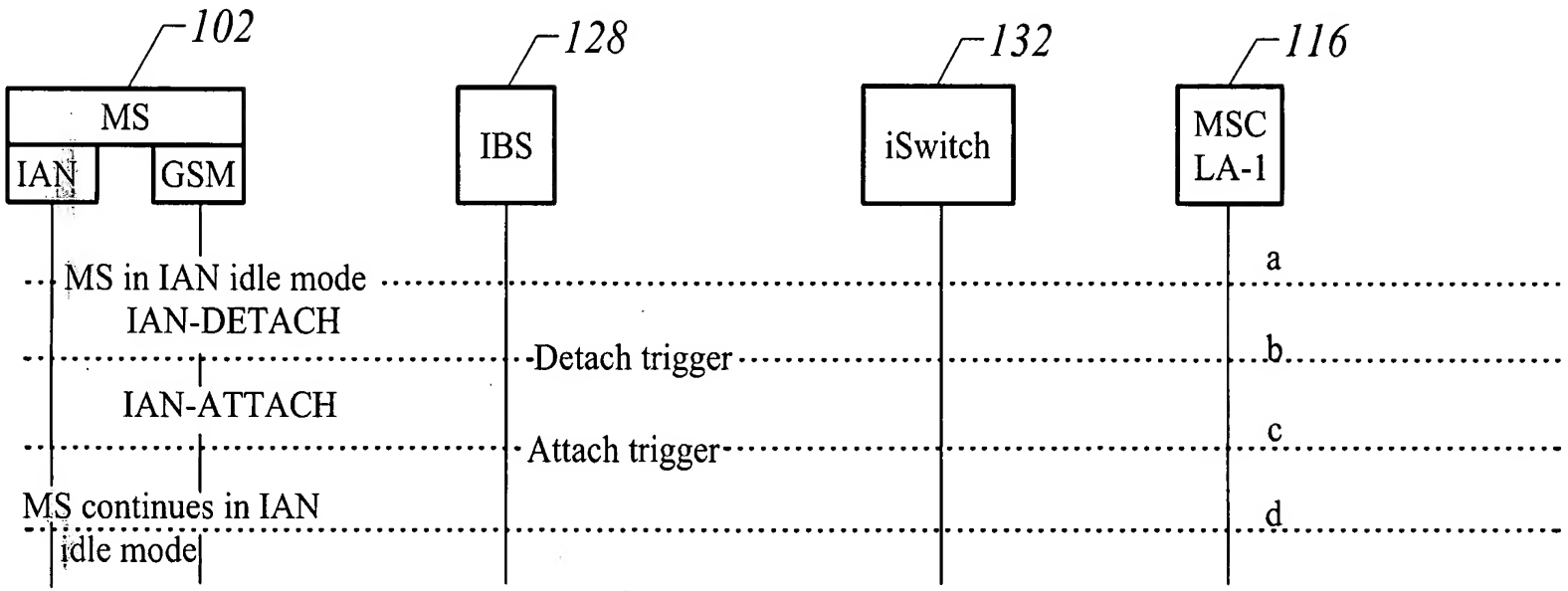
102
128
132
116
MS
IAN
GSM
IBS
iSwitch
MSC
LA-1
MS in IAN idle mode
IAN-DETACH
Detach trigger
IAN-ATTACH
Attach trigger
MS continues in IAN
idle mode
a
b
c
d

FIG. 19

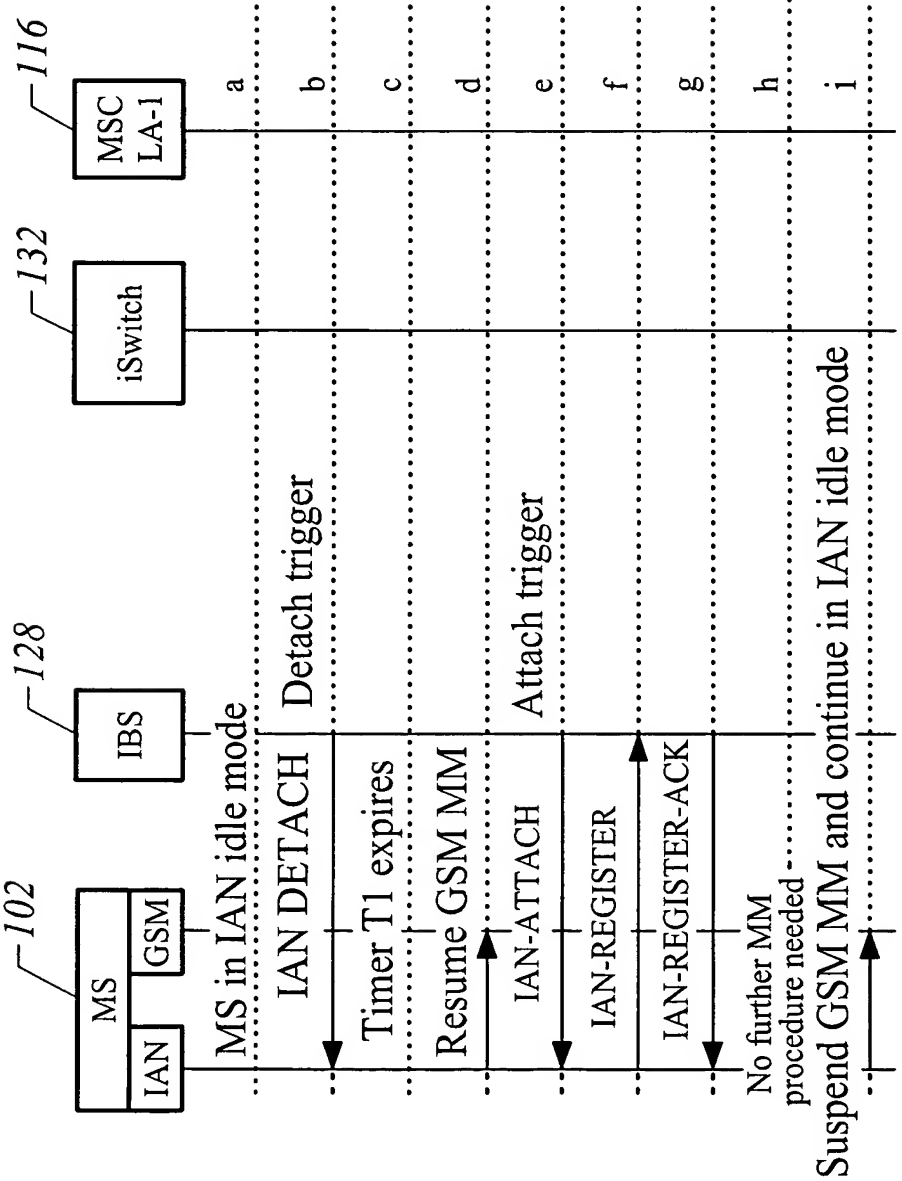
102
MS
IAN
GSM
128
IBS
132
iSwitch
116
MSC
LA-1
MS in IAN idle mode
a
IAN DETACH
Detach trigger
b
Timer T1 expires
c
Resume GSM MM
d
IAN-ATTACH
Attach trigger
e
IAN-REGISTER
f
IAN-REGISTER-ACK
g
No further MM
procedure needed
h
Suspend GSM MM and continue in IAN idle mode
i

FIG. 20

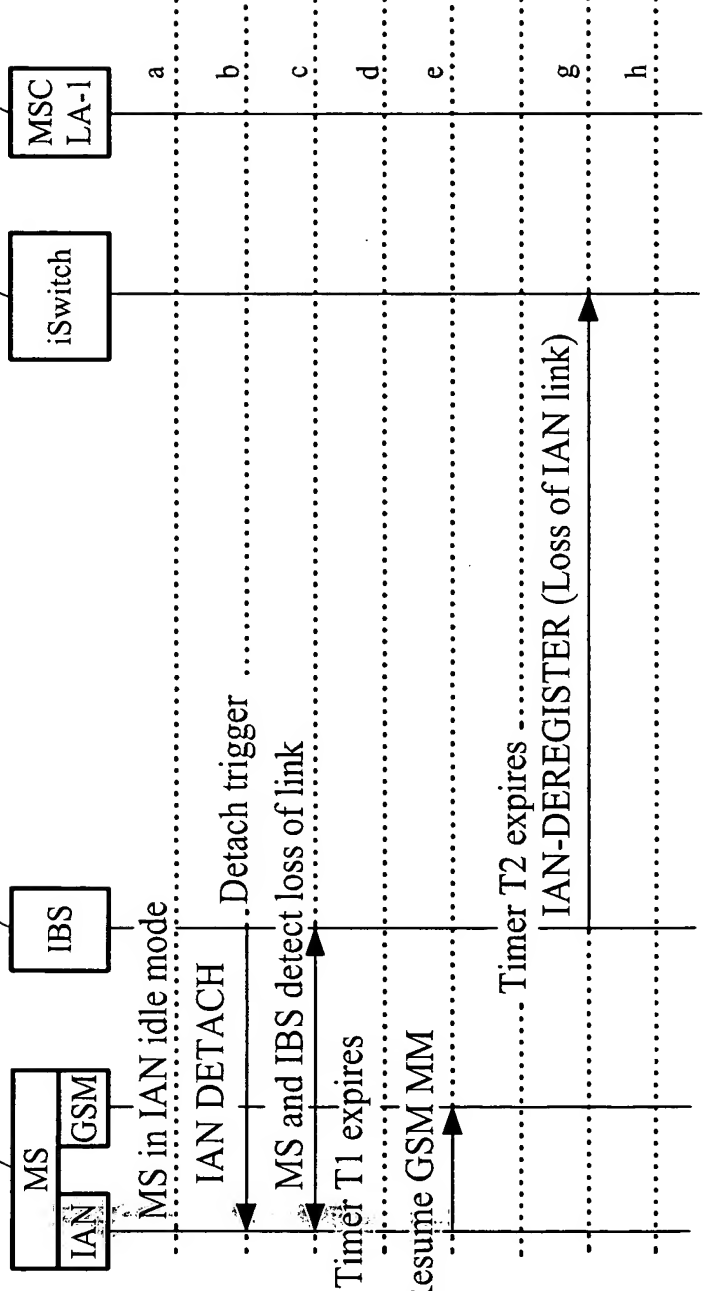
102
MS
IAN
GSM
128
IBS
132
iSwitch
116
MSC
LA-1
a
b
c
d
e
g
h
MS in IAN idle mode
IAN DETACH
Detach trigger
MS and IBS detect loss of link
Timer T1 expires
Resume GSM MM
Timer T2 expires
IAN-DEREGISTER (Loss of IAN link)

FIG. 21

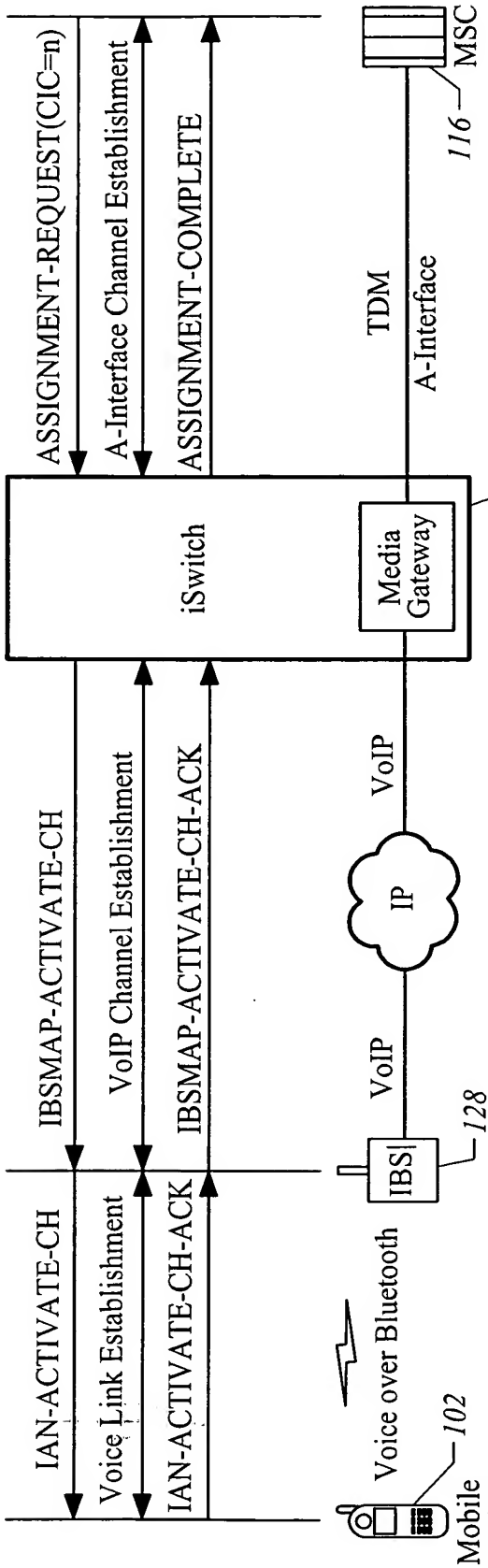
ASSIGNMENT-REQUEST(CIC=n)
A-Interface Channel Establishment
ASSIGNMENT-COMPLETE
MSC
116
TDM
A-Interface
iSwitch
Media Gateway
132
IBSMAP-ACTIVATE-CH
VoIP Channel Establishment
IBSMAP-ACTIVATE-CH-ACK
VoIP
VoIP
IP
IAN-ACTIVATE-CH
Voice Link Establishment
IAN-ACTIVATE-CH-ACK
IBS
128
Voice over Bluetooth
102
Mobile Station

FIG. 22

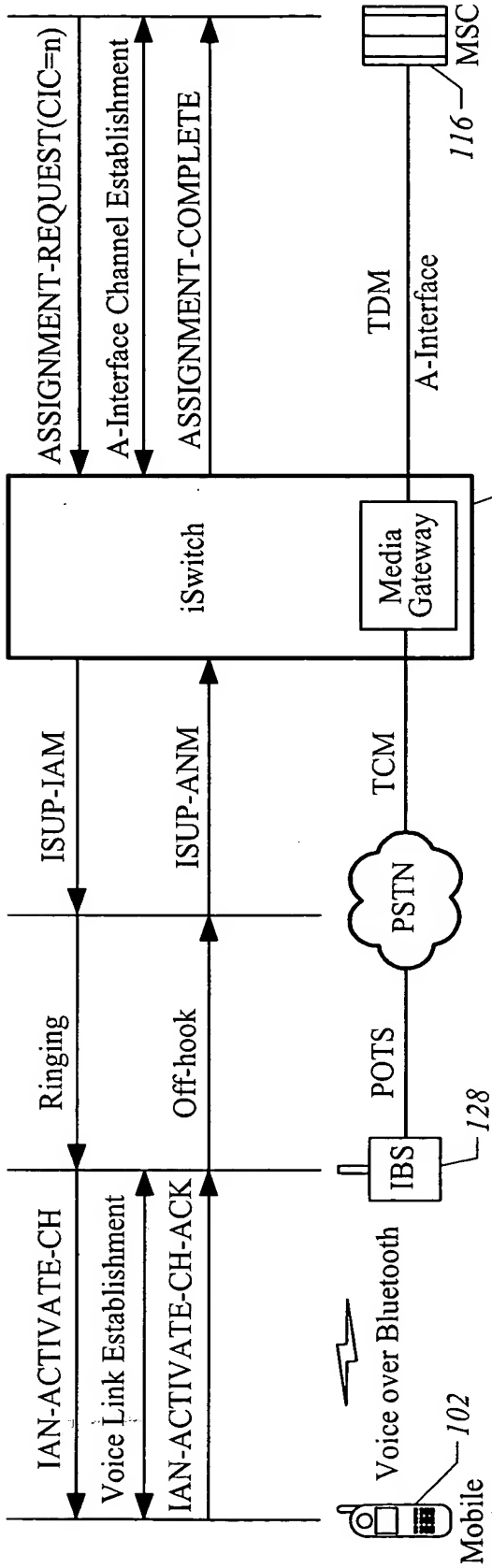
ASSIGNMENT-REQUEST(CIC=n)
A-Interface Channel Establishment
ASSIGNMENT-COMPLETE
MSC
116
TDM
A-Interface
132
iSwitch
Media Gateway
ISUP-IAM
ISUP-ANM
TCM
PSTN
Ringing
Off-hook
POTS
IBS
128
IAN-ACTIVATE-CH
Voice Link Establishment
IAN-ACTIVATE-CH-ACK
Voice over Bluetooth
102
Mobile Station

FIG. 23

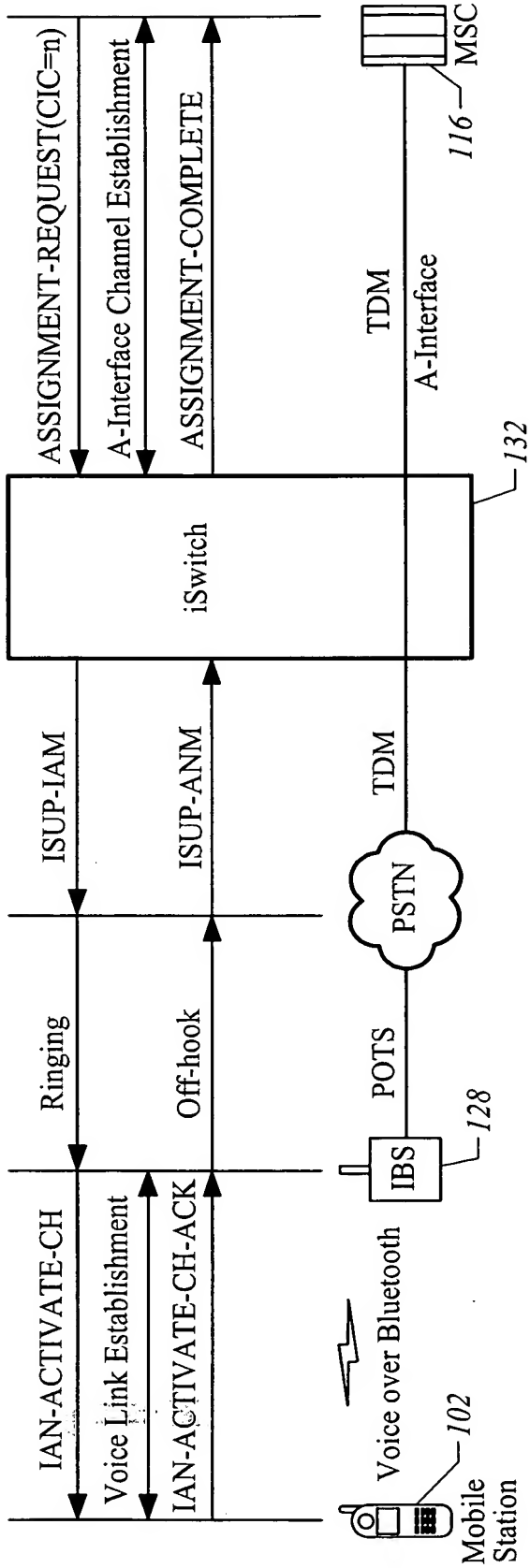
IAN-ACTIVATE-CH
Voice Link Establishment
IAN-ACTIVATE-CH-ACK
Ringing
Off-hook
ISUP-IAM
ISUP-ANM
ASSIGNMENT-REQUEST(CIC=n)
A-Interface Channel Establishment
ASSIGNMENT-COMPLETE
Mobile Station
102
Voice over Bluetooth
IBS
128
POTS
PSTN
TDM
iSwitch
132
TDM
A-Interface
MSC
116

FIG. 24

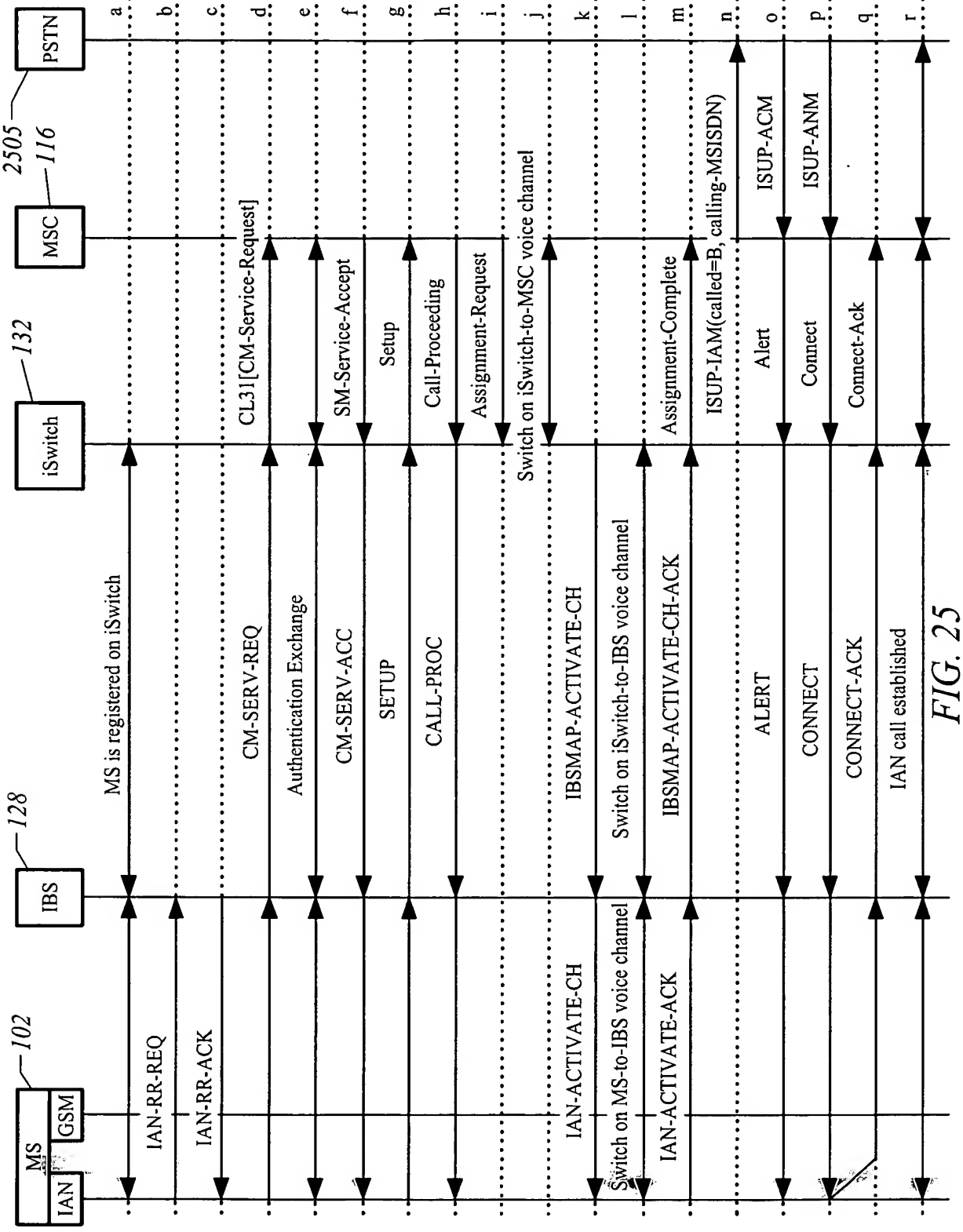
MS
IAN
GSM
102
IBS
128
iSwitch
132
MSC
116
2505
PSTN
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
MS is registered on iSwitch
IAN-RR-REQ
IAN-RR-ACK
CM-SERV-REQ
CL31[CM-Service-Request]
Authentication Exchange
CM-SERV-ACC
SM-Service-Accept
SETUP
Setup
CALL-PROC
Call-Proceeding
Assignment-Request
Switch on iSwitch-to-MSC voice channel
IAN-ACTIVATE-CH
IBSMAP-ACTIVATE-CH
Switch on MS-to-IBS voice channel
Switch on iSwitch-to-IBS voice channel
IAN-ACTIVATE-ACK
IBSMAP-ACTIVATE-CH-ACK
Assignment-Complete
ISUP-IAM(called=B, calling-MSISDN)
ALERT
Alert
ISUP-ACM
CONNECT
Connect
ISUP-ANM
CONNECT-ACK
Connect-Ack
IAN call established

FIG. 25

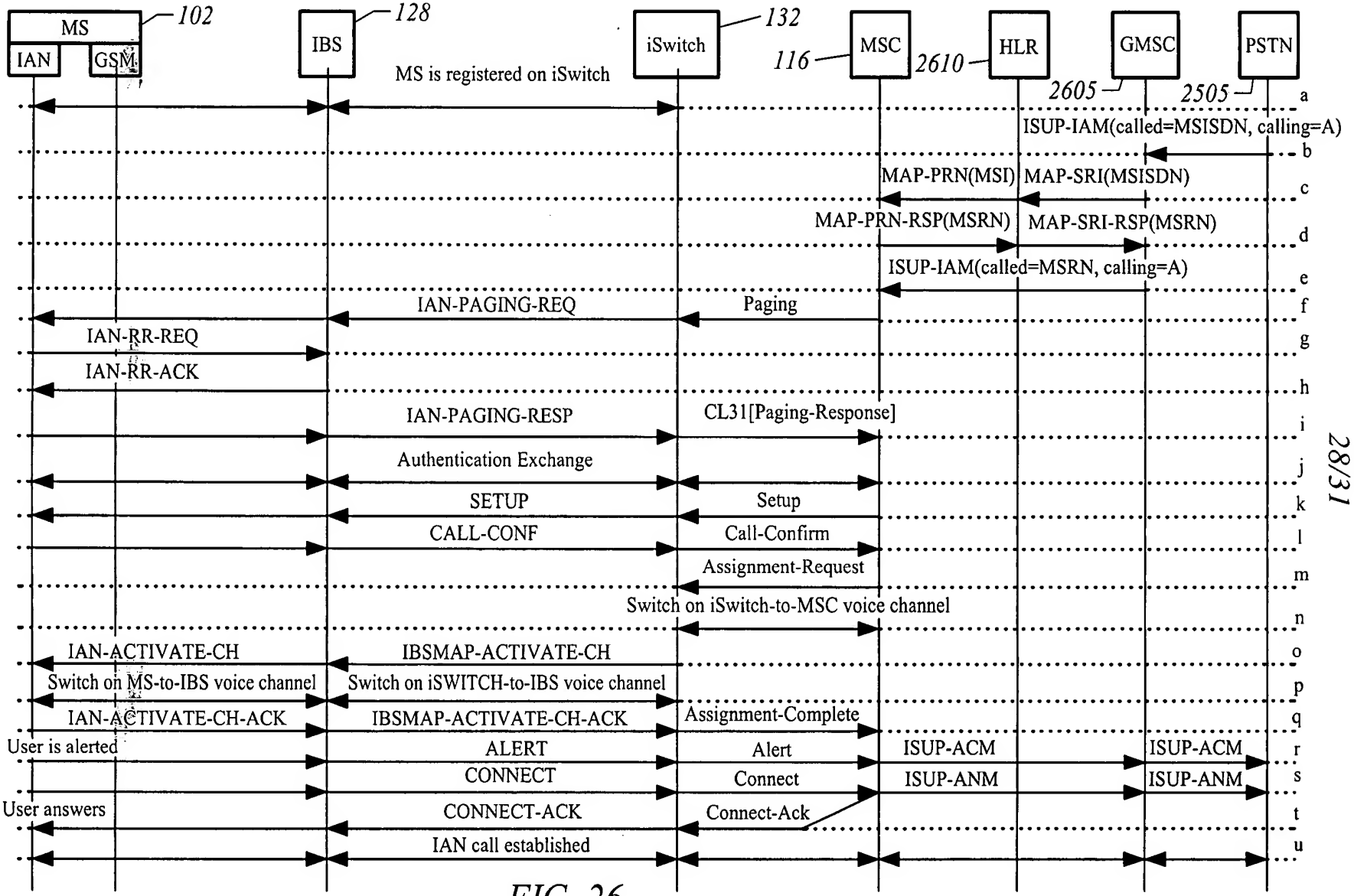
MS
IAN
GSM
102
IBS
128
iSwitch
132
116
MSC
2610
HLR
2605
GMSC
2505
PSTN
MS is registered on iSwitch
ISUP-IAM(called=MSISDN, calling=A)
MAP-PRN(MSI)
MAP-SRI(MSISDN)
MAP-PRN-RSP(MSRN)
MAP-SRI-RSP(MSRN)
ISUP-IAM(called=MSRN, calling=A)
IAN-PAGING-REQ
Paging
IAN-RR-REQ
IAN-RR-ACK
IAN-PAGING-RESP
CL31[Paging-Response]
Authentication Exchange
SETUP
Setup
CALL-CONF
Call-Confirm
Assignment-Request
Switch on iSwitch-to-MSC voice channel
IAN-ACTIVATE-CH
IBSMAP-ACTIVATE-CH
Switch on MS-to-IBS voice channel
Switch on iSWITCH-to-IBS voice channel
IAN-ACTIVATE-CH-ACK
IBSMAP-ACTIVATE-CH-ACK
Assignment-Complete
User is alerted
ALERT
Alert
ISUP-ACM
ISUP-ACM
CONNECT
Connect
ISUP-ANM
ISUP-ANM
User answers
CONNECT-ACK
Connect-Ack
IAN call established
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s
t
u

FIG. 26

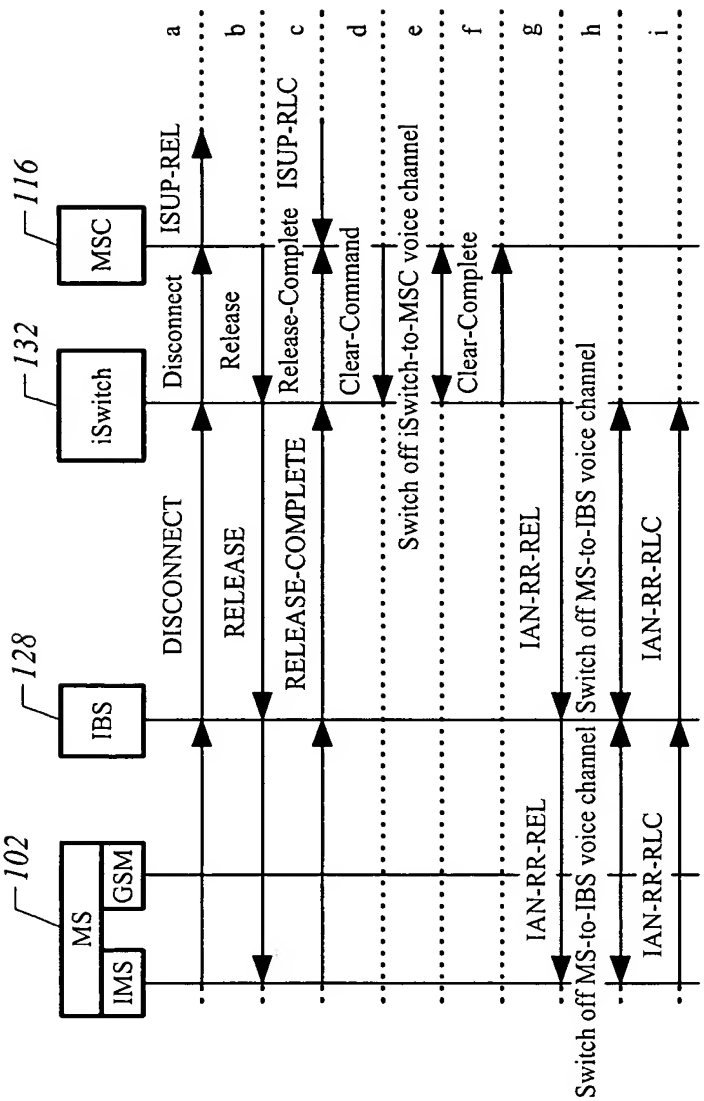
102
MS
IMS
GSM
128
IBS
132
iSwitch
116
MSC
DISCONNECT
Disconnect
ISUP-REL
a
RELEASE
Release
b
RELEASE-COMPLETE
Release-Complete
ISUP-RLC
c
Clear-Command
d
Switch off iSwitch-to-MSC voice channel
e
Clear-Complete
f
IAN-RR-REL
g
Switch off MS-to-IBS voice channel
h
IAN-RR-RLC
i

FIG. 27

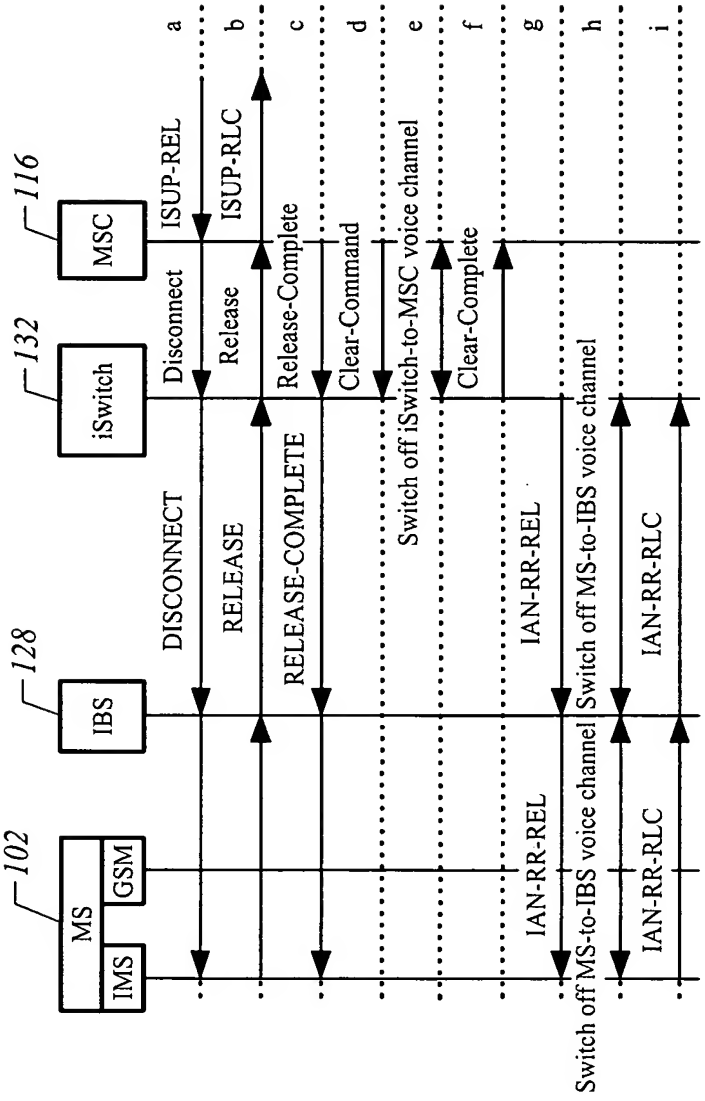
102
MS
IMS
GSM
128
IBS
132
iSwitch
116
MSC
DISCONNECT
Disconnect
ISUP-REL
a
RELEASE
Release
ISUP-RLC
b
RELEASE-COMPLETE
Release-Complete
c
Clear-Command
d
Switch off iSwitch-to-MSC voice channel
e
Clear-Complete
f
IAN-RR-REL
g
Switch off MS-to-IBS voice channel
Switch off MS-to-IBS voice channel
h
IAN-RR-RLC
IAN-RR-RLC
i

FIG. 28

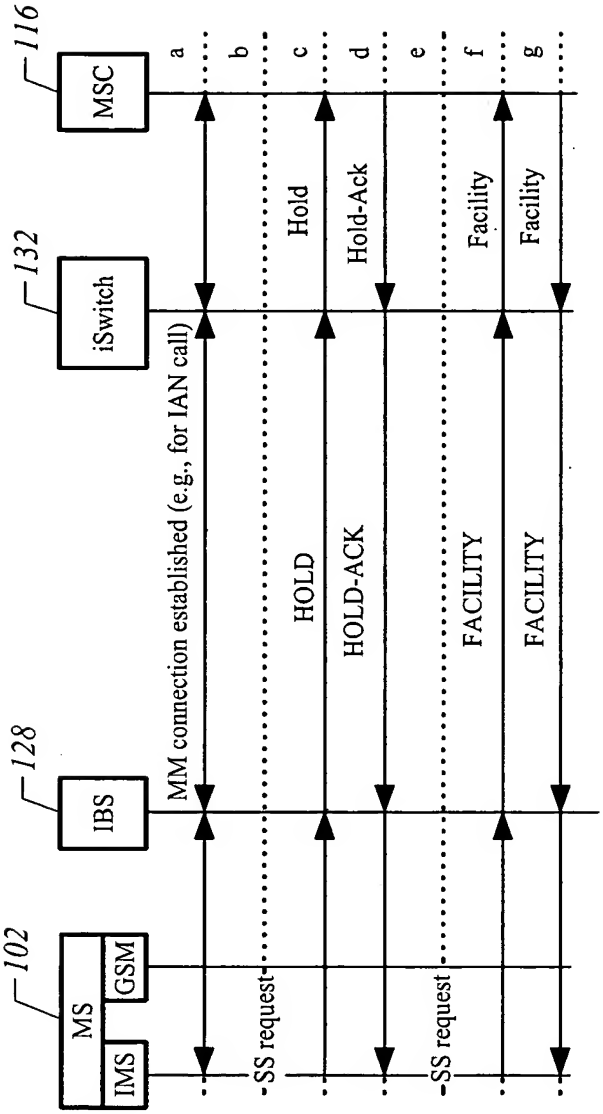
102
MS
IMS
GSM
128
IBS
132
iSwitch
116
MSC
a
b
c
d
e
f
g
MM connection established (e.g., for IAN call)
SS request
HOLD
Hold
HOLD-ACK
Hold-Ack
SS request
FACILITY
Facility
FACILITY
Facility

FIG. 29